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UTILITY PATENT APPLICATION TRANSMITTAL
(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No. 081862.P184
(maximum 12 characters)

First Named Inventor Alex Truong

Title: METHOD AND SYSTEM FOR CONTROLLING TASKS ON NETWORK CARDS

Express Mail Label No. EL672753298US

ADDRESS TO:	Assistant Commissioner for Patents Box Patent Application Washington, D. C. 20231

APPLICATION ELEMENTS
See MPEP chapter 600 concerning utility patent application contents.

1. __X__ **Fee Transmittal Form (e.g., PTO/SB/17)**
(Submit an original, and a duplicate for fee processing)

2. _____ **Applicant Claims Small Entity Status. (37 CFR 1.27)**

3. __X__ **Specification   (Total Pages ___23___)**
(preferred arrangement set forth below)
- Descriptive Title of the Invention
- Cross Reference to Related Applications
- Statement Regarding Fed sponsored R & D
- Reference sequence listing, a table,
  or a computer program listing appendix
- Background of the Invention
- Brief Summary of the Invention
- Brief Description of the Drawings (if filed)
- Detailed Description
- Claim(s)
- Abstract of the Disclosure

4. __X__ **Drawings(s) (35 USC 113)   (Total Sheets _6_)**

5. __X__ **Oath or Declaration   (Total Pages _6_)**

     a. ____ Newly Executed (Original or Copy)

     b. ____ Copy from a Prior Application (37 CFR 1.63(d))
(for Continuation/Divisional with Box 17 completed)

     i. ____ <u>DELETIONS OF INVENTOR(S)</u> Signed statement attached deleting
inventor(s) named in the prior application, see 37 CFR 1.63(d)(2)
and 1.33(b).

     c. _X_ Unsigned.

6. _____ **Application Data Sheet. (37 CFR 1.76)**

7. _____ CD-ROM or CD-R in duplicate, large table or Computer Program (Appendix)

8. _____ Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)
  a ____ Computer Readable Form (CRF)

  b ____ Specification Sequence Listing on
    i _____CD-ROM or CD-R (2 copies), or
    ii. _____ paper
  c. ____ Statement verifying identity of above copies

11/15/00   - 1 -

ACCOMPANYING APPLICATION PARTS

9. _____ **Assignment Papers (cover sheet & documents(s))**

10. _____ a. Separate 37 CFR 3.73(b) Statement (where there is an assignee)

___X___ b. Power of Attorney (Unexecuted)

11. _____ English Translation Document (if applicable)

12. _____ a. Information Disclosure Statement (IDS)/PTO-1449

_____ b. Copies of IDS Citations

13. _____ **Preliminary Amendment**

14. ___X___ **Return Receipt Postcard (MPEP 503) (Should be specifically itemized)**

15. _____ Certified Copy of Priority Document(s) (if foreign priority is claimed)

16. _____ Request and Certification under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or its equivalent.

17. ___X___ Other: ___Copy of Postcard w/Express Mail Stamp.___

18A. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information:

_____ **Continuation** _____ **Divisional** _____ **Continuation-in-part (CIP)**
Of Prior Application No.: _____ **Examiner** _____ **Group Art Unit** _____

(which is a ___ continuation/ ___ divisional/ ___ CIP of prior application no. _____,
which is a ___ continuation/ ___ divisional/ ___ CIP of prior application no. _____) (List entire chain of priority)

For CONTINUATION AND DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 5b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

18B. Statement under 37 CFR 3.73(b) for <u>continuing</u> application:
The undersigned states that _____ **(name of assignee) is the assignee of the entire right, title, and interest in the accompanying patent application by virtue of an assignment recorded in the Patent and Trademark Office at Reel. No. _____ Frame No. _____ (or a copy of which is attached).**

---

19. Correspondence Address

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FEE TRANSMITTAL FOR FY 2001

TOTAL AMOUNT OF PAYMENT ($) $1,582.00

Complete if Known:
Application No.   Not Assigned
Filing Date _Herewith_
First Named Inventor _Alex Truong_
Group Art Unit _Not Assigned_
Examiner Name _Not Assigned_
Attorney Docket No. _081862.P184_

METHOD OF PAYMENT (check one)

1.   [X]   **The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:**

    Deposit Account Number   02-2666
    Deposit Account Name   _____

    [X]   **Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17**

    [   ]   **Applicant claims small entity status. See 37 CFR 1.27**

2.   __X__   **Payment Enclosed:**   __X__   **Check**
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                        _____   **Other**

FEE CALCULATION

1.   BASIC FILING FEE

Large Entity		Small Entity			
Fee Code	Fee ($)	Fee Code	Fee ($)	**Fee Description**	**Fee Paid**
101	710	201	355	Utility application filing fee	710.00
106	320	206	160	Design application filing fee	_____
107	490	207	245	Plant filing fee	_____
108	710	208	355	Reissue filing fee	_____
114	150	214	75	Provisional application filing fee	_____

SUBTOTAL (1) $ 710.00

2.   EXTRA CLAIM FEES

	Extra Claims	Fee from below	Fee Paid
Total Claims __24__ − 20** = __4__		X $18.00	= $72.00
Independent Claims _13_ − 3** = __10__		X $80.00	= $800.00
Multiple Dependent		_____	= _____

**Or number previously paid, if greater; For Reissues, see below.

Large Entity		Small Entity		
Fee Code	Fee ($)	Fee Code	Fee ($)	**Fee Description**
103	18	203	9	Claims in excess of 20
102	80	202	40	Independent claims in excess of 3
104	270	204	135	Multiple dependent claim, if not paid
109	80	209	40	**Reissue independent claims over original patent
110	18	210	9	**Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) $ 872.00

11/08/00   - 1 -

FEE CALCULATION (continued)

3.   ADDITIONAL FEES

Large Entity		Small Entity			
Fee Code	Fee ($)	Fee Code	Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	_____
127	50	227	25	Surcharge - late provisional filing fee or cover sheet	_____
139	130	139	130	Non-English specification	_____
147	2,520	147	2,520	For filing a request for ex parte reexamination	_____
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	_____
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	_____
115	110	215	55	Extension for reply within first month	_____
116	390	216	195	Extension for reply within second month	_____
117	890	217	445	Extension for reply within third month	_____
118	1,390	218	695	Extension for reply within fourth month	_____
128	1,890	228	945	Extension for reply within fifth month	_____
119	310	219	155	Notice of Appeal	_____
120	310	220	155	Filing a brief in support of an appeal	_____
121	270	221	135	Request for oral hearing	_____
138	1,510	138	1,510	Petition to institute a public use proceeding	_____
140	110	240	55	Petition to revive – unavoidable	_____
141	1,240	241	620	Petition to revive - unintentional	_____
142	1,240	242	620	Utility issue fee (or reissue)	_____
143	440	243	220	Design issue fee	_____
144	600	244	300	Plant issue fee	_____
122	130	122	130	Petitions to the Commissioner	_____
123	130	123	130	Petitions related to provisional applications	_____
126	180	126	180	Submission of Information Disclosure Stmt	_____
581	40	581	40	Recording each patent assignment per property (times number of properties)	_____
146	710	246	355	For filing a submission after final rejection (see 37 CFR 1.129(a))	_____
149	710	249	355	For each additional invention to be examined (see 37 CFR 1.129(b))	_____
179	710	279	355	Request for Continued Examination (RCE)	_____
169	900	169	900	Request for expedited examination of a design application	_____

Other fee (specify)   _____   _____

Other fee (specify)   _____   _____

SUBTOTAL (3) $ 0 _____

*Reduced by Basic Filing Fee Paid

SUBMITTED BY:

Typed or Printed Name: Sanjeet K. Dutta

Signature: _Sanjeet Dutta_   Date: 11/28/2000

Reg. Number: 46,145   Telephone Number: (408) 720-8300

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UNITED STATES PATENT APPLICATION

FOR

METHOD AND SYSTEM FOR CONTROLLING

TASKS ON NETWORK CARDS

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"Express Mail" mailing label number__EL672753298US_____
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METHOD AND SYSTEM FOR CONTROLLING

TASKS ON NETWORK CARDS

Field of the Invention

The present invention pertains to communications and networking. More particularly, the invention relates to the usage of resources in networking devices.

Background of the Invention

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Wide area switches for data communications such as asynchronous transfer mode (ATM) packets and Internet Protocol ("IP") data packets can hold numerous modular cards. Switches include controller cards which allow and direct different functions in the Switch. In a redundant configuration, a controller card is active while a second controller card stands-by should the active one fail. The controller cards may be a processor switch module or line cards. Specifically, the controller card coordinates switchwide operations such as the sequencing of the initialization of a node. Again in a redundant system, an active card line card is backed up by a standby line card. Line cards may be an ATM switching module.

10

Controller cards execute multiple tasks that may include initializing databases, setting up communication end-points, and configuration methods for users. These tasks may be executed each time certain system operations are performed. Examples of system operations may include when a system is brought up, when an active to standby card switchover or standby to active card switchover occurs, or when software is upgraded on a controller card.

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However, prior systems performed the system operations inconsistently. For example, each card in a switch may execute the tasks required for an active to standby

card switchover in a different sequence. These prior systems may not achieve high

reliability or availability. Nor would prior systems properly and efficiently manage faults

in the system. Furthermore, prior systems failed to facilitate system development and

integration where multiple groups of engineers work on the same complex system.

5

SUMMARY OF THE INVENTION

What is disclosed is a method and system for controlling tasks performed on network cards is disclosed. In one embodiment, the method disclosed controls applications that are executed within the network. The method of controlling the

5 applications comprises transitioning each of the applications between one of a plurality of active states and one of a plurality of standby states.

Other features and advantages of the present invention will be apparent from the accompanying drawings and from the detailed description that follows below.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is illustrated by way of example and not limitations in the figures of the accompanying drawings, in which like references indicate similar elements, and in which:

Figure 1 shows a wide area switch for data communications such as asynchronous transfer mode (ATM) packets and Internet Protocol ("IP") data packets;

Figure 2 shows a generic block diagram of modular card such as a controller card and line card;

Figure 3 shows a block diagram of redundant network cards communicating;

Figure 4 shows the relationship between applications, state machines, and shelf managers;

Figure 5 shows a generic application state transition diagram;

Figure 6A shows an active to standby graceful switchover;

Figure 6B shows a standby to active graceful switchover;

Figure 6C shows an active to standby upgrade switchover; and

Figure 6D shows a standby to active upgrade switchover.

DETAILED DESCRIPTION

A method and system for controlling network cards is disclosed. As described in detail below, in one embodiment of the present invention a switch with redundant network cards includes a central processing unit (CPU) subsystem for controlling the state of applications (or tasks) running on the switch. Applications may include graceful switchovers and initialization of nodes.

Figure 1 shows a wide area switch for data communications such as asynchronous transfer mode (ATM) packets and Internet Protocol ("IP") data packets. For example, the switch may be a switch similar to those manufactured by Cisco Technology, Inc. of San Jose, California. Switch 100 can hold numerous modular cards 110-140 and includes controller cards 110 and 120. Specifically, the controller cards 110 and 120 coordinate switchwide operations such as the sequencing of the initialization of a node. In a redundant system, controller card 110 is the active card and controller card 120 is a standby card. Controller cards 110 and 120 may be a processor switch module such as those manufactured by Cisco Technology, Inc. Also included in Switch 100 are line cards 130 and 140. Again in a redundant system, line card 130 is the active card and line card 140 is the standby card. Line cards 130 and 140 may be an ATM switching module, such as those manufactured by Cisco Technology, Inc, or similar switch manufacturers. As shown in the blowup of **Figure 1**, each card 110-140 contains a CPU subsystem 150. CPU subsystem 150 will be described in detail below.

Although switch 100 only shows four cards, numerous cards may be implemented of various types. **Figure 2** shows a generic block diagram of modular card such as controller cards 110 and 120 and line cards 130 and 140. Card 200 includes a

CPU subsystem 150. Within CPU subsystem 150 is a system controller 220, which interfaces with random access memory 240 and PCI bus 270. Also within CPU subsystem 150 is central processing unit (CPU) 230. CPU 230 may be a MIPS™ microprocessor sold by MIPS Technologies, Inc. of Mountain View, California. For alternate embodiments, CPU 230 may be another type of processor.

Although embodiments of the present invention are described as having both software and hardware elements, alternative embodiments may be all hardware, all software, or a combination of each. The software implementing the present invention can be stored in RAM 240, a mass storage device available through disk interface 290, or other storage medium accessible to CPU 230. This software may also be resident on an article of manufacture comprising a computer usable mass storage medium or propagated digital signal having computer readable program code embodied therein and being readable by the mass storage medium and for causing CPU 230 to control tasks on networking cards in accordance with the teachings herein.

System controller 220 also interfaces with Ethernet port 250 for communications with a local area network (LAN) as well as serial port 260. Card 200 also includes an ATM segmentation and reassembly device (SAR) 295 as well as special hardware 285. Special hardware 285 may include a line terminator if the card 200 is a line card, or the special hardware 285 may include switching fabric if the card 200 is a processor switching module. ATM/SAR 295, Disk interface 290, and special hardware 285 are all connected to the system controller 220 via PCI bus 270.

Figure 3 shows a block diagram of redundant network cards communicating. Network Cards 310 are line cards with an active line card 311 and standby line card

312. Network cards 310 include CPU subsystems 150, as well as, line terminations 314.

Network cards 320 are switching cards with an active line card 321 and standby line card 322. Network cards 320 include CPU subsystems 150, as well as, switching fabric 324. Switching fabric 324 may be an Application Specific Integrated Circuit (ASIC)-based high-performance traffic switching module. Network cards 330 are also line cards and share similar physical characteristics as network cards 310. However, network cards 330 receive digital data packets. The digital data packets may be ATM cells 340 or similar user traffic. User traffic travels from the line cards 330, through switching card 320 to another set of line cards 310.

Network cards 310, 320 and 330 include Application Life Cycle State Machines 350. State machines 350 control the state of a network card, as well as, the operation of each application performed on a network card. For example, while the application is initially brought up, when active-standby switchovers occur, and when software is upgraded on network cards. State machines 350 also set rules for an application's behavior while the application is in a given state. In addition state machines 350 message errors and faults that occur during the operation of network cards. Upon discovering problems in an application, state machines 350 perform error recovery actions, which may include executing a card restart.

Figure 4 shows the relationship between applications, state machines, and shelf managers. The shelf manager 440 resides on network card 2 420. Application State Machines (ASMs) 450 reside on each network card 410, 420, and 430. Applications 460 are running on each card. An application is a set of code that implements a certain

portion of the overall card functionality. An application can have one or more tasks.

Examples of applications are the private network-to-network interface (PNNI) and call

control, Connection Provisioning (CPRO) and Card Equipment Management Application

(CEMA). **Figure 4** shows ASM 450 communicating with shelf manager 440 via a

messaging protocol. ASM 450 communicate with application using 460 using a

functional Application Program Interface (API).

The shelf manager 440 provides events to the ASM 450, which then translates

some of the card events into finer grained events for execution by the applications 460.

An event is a notification to applications 460 of a significant shelf-level or card-level

change. Events may notify an application 460 of local or remote card role or state

changes, or card-level resource congestion, for example, ASM 450 provides an API to

local applications 460 to generate events destined for other applications on the same

card. ASM 450 handles delivery of events coming from both the shelf manager 440 and

the local applications 460.

ASM 450 is responsible for bringing the card up from the Initialization state to the

Read state. In an initialization state, only the ASM 450 is running with life support-

information tasks, such as, a task monitor. In a ready state, the entire card with all its

applications are operational.

Figure 5 shows a generic application state transition diagram. The application is

spawned in block 505. Each application is started when ASM 450 spawns application

root tasks. The application is responsible for spawning all its other tasks. During

initialization many operations are performed. For example, endpoints are created,

database clients are registered and data structures are initialized. After these various operations are completed, the application's state transitions to INIT_DONE 510.

From the INIT_DONE 510 state, the application may enter APP_ACTIVE_READY state 515. By entering the state of block 515, the application is ready on an active network card. When transitioning from INIT_DONE 510 to APP_ACTIVE_READY 515, random access memory (RAM) is loaded with all necessary commands to execute the application from a disk database. Also during the transition a confirmation request is made to determine if the APP_ACTIVE_READY state 515 has been reached. Also from the INIT_DONE state 510, the application may enter an APP_STANDBY_READY state 520. By entering state 520, the application is on standby, on a standby network card. When transitioning from INIT_DONE state 510 to APP_STANDBY_READY state 520, RAM is loaded with all necessary commands to execute the application from the Active Network card. Also during the transition, a confirmation request is made to determine if the APP_STANDBY_READY state 520 has been reached.

Also from the INIT_DONE state 510, the application may enter an APP_NO_PROVSN state 535. By entering state 535, the application is in a no provisioning state in which it rejects all simple network management protocol (SNMP) set requests, as well as, command line interface (CLI) set requests. The application can still process SNMP get request. NO_PRVSN state 535 may be used during Upgrade/Downgrade procedures, during configuring Upload and graceful switchovers, while in state 535, the application is prevented from writing to the disk database. While in state 535 RAM may be read or written to, however some disk access is limited to

read operations only. For example, configuration database disk access is limited to read operations only. But, disk write access is allowed for non-configuration disk access operations, such as statistic collection. When transitioning from INIT_DONE 510 to NO_PROVSN 535, RAM is built from the disk database. Also during the transition, a confirmation request is made to determine if the APP_NO_PROVSN state 535 has been reached. When in the APP_NO_PROVSN 335 state, the network card is in an active state.

An application can transition from APP_STANDBY_READY 520 to APP_ACTIVE_READY 515. When transitioning, the RAM is synchronized with the disk database, if needed. A confirmation request is also made. The network card may go from standby to active. Likewise, APP_ACTIVE_READY, state 515 may transition to APP_STANDBY_READY state 520. However, the RAM is built from the standby network card. Similarly, a confirmation request is made.

Both APP_ACTIVE_READY 515, and APP_STANDBY_READY 520 may transition to and from APP_NO_PROVSN 535. Transitioning from state 520 to state 535 involves a confirmation request that the APP_NO_PROVSN state 535 has been reached. Transitioning from state 515 to state 535 involves flushing the disk and then confirming the state change. Transitioning from APP_NO_PROVSN 535 to APP_ACTIVE_READY 515 involves a confirmation request. However, transitioning from state 535 to APP_STANDBY_READY 520 involves building RAM from the active network card if required, as well, as, a confirmation request.

Another state may be attained from APP_ACTIVE_READY 515, that is APP_QUIESCENT 530. Transitioning from APP_ACTIVE_READY 515 to

APP_QUIESCENT 530 involves synchronizing RAM with the standby card, as well as flushing the data to the disk. A confirmation of the state transition also occurs. APP_QUIESCENT 530 is a quiescent state in which an application is being prepared for a graceful switchover. While in the quiescent state, the application does not make

5   changes to its RAM databases and its internal state. An application's internal state that is resynchronized with a standby peer application may include communication endpoint queues, RAM, and/or disk databases or Battery Random Access Memory (BRAM) content-Applications do process ASM 450 events while in APP_QUIESCENT 530. An application can be ineligible for entering the quiescent state. Furthermore, an

10   application can include parameters that limit the amount of time the application is in the APP_QUIESCENT state 530. Applications may receive requests that result in RAM database changes while in the APP_QUIESCENT state 530. Both RAM and disk access is read-only in the quiescent state. The application may transition back from state 530 to APP_ACTIVE_READY state 515. This transition involves a confirmation of

15   the change to state 515.

The application may also transition to state 530 from APP_NO_PROVSN state 535. This transition involves synchronizing the RAM of the active and standby applications. All non-database data is flushed to the disk. A confirmation of the state transition is also made. When transitioning from state 530 to state 535, neither

20   synchronization nor flushing are required. However, a confirmation of the state transition occurs.

The APP_QUIESCENT state 530 may also transition to APP_STANDBY_READY 520. A confirmation occurs. However,

APP_STANDBY_READY 520 does not transition back to APP_QUIESCENT state 530. This transition changes the state of the application from active to standby.

Another transition may occur from APP_QUIESCENT state 530 to APP_STANDBY_LOCKED 525. A confirmation is performed. The standby locked state 525 places applications in a ready state, but the application does not contact the active peer application, nor does it integrate any data from active peer application. The internal databases are locked in this state. This state may be used during upgrade/downgrade procedures. There is read-only RAM access and disk access.

The only transition made from APP_STANDBY_LOCKED state 525 is to APP_NO_PROVSN state 535. The transition involves a confirmation request and the application returns to an active state.

Figures 6A-6D shows examples of state transitions during graceful and upgrade switchovers. **Figure 6A** shows an active to standby graceful switchover. Applications on the active card transition through 1 to the quiescent state. From the quiescent state, the active applications transition through 2 to the APP_STANDBY_RDY state. **Figure 6B** shows a standby to active graceful switchover. Applications on the standby card transition through 3 to the active ready state.

Figure 6C shows an active to standby upgrade switchover. Applications on the active card transition through 1 to the no provisioning state. From the no provisioning state, applications transition thought 2 to the quiescent state. From the quiescent state, applications transition through 3 to the standby locked state at which point the applications have transitioned to STANDBY.

Figure 6D shows a standby to active upgrade switchover. Applications on the standby card transition through 4 to the no provisioning state. From the no provisioning state applications transition to the active ready state. Alternate embodiments may include different state transitions.

5   During graceful transitions from the active state to the standby state, the application is not restarted, but rather gracefully transitioned through a quiescent state to the standby state.

During a software upgrade, the application transitions from the active state into a locked state where it "hibernates" until the operator determines that the newly active, higher revision application behaves properly. The locked state eliminates rebuilds (and 10   long outages) if a new-version application fails.

During a software upgrade, the application state machine (ASM) is fault-tolerant while in transition between releases of the software. Failure on the active revision causes a switchover to the inactive revision of the software when the inactive revision is 15   either locked or ready, depending on where the software finds itself.

In the foregoing specification, the invention has been described with reference to specific exemplary embodiments thereof. It will, however, be evident that various modifications and changes may be made thereto without departing from the broader spirit and scope of the invention as set forth in the appended claims. The specification 20   and drawing are, accordingly, to be regarded in an illustrative rather than a restrictive manner.

CLAIMS:

We claim:

1. In a digital communications network, a method for controlling tasks performed on network cards comprising:

    controlling applications executed within the network, wherein controlling the applications comprises,

        transitioning each of the applications between one of a plurality of active states and one of a plurality of standby states.

2. The method of claim 1, wherein an application state machine controls the execution of the application.

3. The method of claim 2, further comprising:

    receiving control messages from a shelf manager; and

    communicating via APIs to the application, wherein the shelf manager may be located on a remote network card.

4. The method of claim 1, wherein the plurality of active states comprise:

    an active ready state;

    a quiescent state; and

    a no provisioning state.

5.   The method of claim 1, wherein the standby states comprise:

a standby ready state, and

a standby locked state.

6.   In a digital communications network, a method for controlling tasks performed on network cards, comprising:

switching the state of an application in an active state to a standby state,

comprising,

transitioning the application from the active state to a quiescent state;

and

transitioning the application from the quiescent state to the standby

state.

7.   In a digital communications network, a method for controlling tasks performed on network cards, comprising:

upgrading code of an application in an active state to a standby locked

state comprising,

transitioning the application from the active state to a no provisioning

state;

transitioning the application from the no provisioning state to a

quiescent state; and

transitioning the application from the quiescent state to the standby

locked state.

1   8.   The method of claim 7, wherein the standby locked state does not allow

2   disk database access nor access to write to RAM.

1   9.   The method of claim 7, wherein the no provisioning state does not allow

2   access to write to a disk database.

1   10.   The method of claim 7, wherein the quiescent state does not allow access

2   to write to a disk database nor access to write to RAM.

1   11.   In a digital communications network, a method for controlling tasks

2   performed on network cards, comprising:

3   upgrading code of an application in an standby state to an active state

4   comprising,

5   transitioning the application from the standby state to a no provisioning

6   state; and

7   transitioning the application from the no provisioning state to the active

8   state.

1   12.   In a digital communications network, a system for controlling tasks

2   performed on network cards comprising:

3   means for controlling applications executed within the network, wherein

4   the means for controlling the applications comprises,

5   means for transitioning each of the applications between one of a

6   plurality of active states and one of a plurality of standby states.

1   13.   The system of claim 12, further comprising:

2   means for receiving control messages from a shelf manager; and

3   means for communicating via APIs to the application, wherein the shelf

4   manager may be located on a remote network card.

1   14.   In a digital communications network, a system for controlling tasks

2   performed on network cards, comprising:

3   means for switching the state of an application in an active state to a

4   standby state, comprising,

5   means for transitioning the application from the active state to a

6   quiescent state; and

7   means for transitioning the application from the quiescent state to the

8   standby state.

1   15.   In a digital communications network, a system for controlling tasks

2   performed on network cards, comprising:

3   means for upgrading code of an application in an active state to a standby

4   locked state comprising,

5   means for transitioning the application from the active state to a no

6   provisioning state;

7   means for transitioning the application from the no provisioning state to

8   a quiescent state; and

9   means for transitioning the application from the quiescent state to the

10   standby locked state.

1   16.   In a digital communications network, a system for controlling tasks

2   performed on network cards, comprising:

3   means for upgrading code of an application in an standby state to an

4   active state comprising,

5   means for transitioning the application from the standby state to a no

6   provisioning state; and

7   means for transitioning the application from the no provisioning state to

8   the active state.

1   17.   A computer readable medium having stored thereon a plurality of

2   instructions for controlling tasks performed on network cards, said plurality of

3   instructions when executed by a computer, cause said computer to perform:

4   controlling applications executed within the network, wherein controlling

5   the applications comprises,

6   transitioning each of the applications between one of a plurality of active

7   states and one of a plurality of standby states.

18.   The computer-readable medium of claim 17 having stored thereon additional instructions, said additional instructions when executed by a computer, cause said computer to further perform:

    receiving control messages from a shelf manager; and

    means for communicating via APIs to the application, wherein the shelf manager may be located on a remote network card.

19.   A computer readable medium having stored thereon a plurality of instructions for controlling tasks performed on network cards, said plurality of instructions when executed by a computer, cause said computer to perform:

    switching the state of an application in an active state to a standby state, comprising,

        transitioning the application from the active state to a quiescent state; and

        transitioning the application from the quiescent state to the standby state.

20.   A computer readable medium having stored thereon a plurality of instructions for controlling tasks performed on network cards, said plurality of instructions when executed by a computer, cause said computer to perform:

    synchronizing the primary and secondary controllers;

6   upgrading code of an application in an active state to a standby locked

7   state comprising,

8   transitioning the application from the active state to a no provisioning

9   state;

10   transitioning the application from the no provisioning state to a

11   quiescent state; and

12   transitioning the application from the quiescent state to the standby

13   locked state.

21.   A computer readable medium having stored thereon a plurality of

instructions for controlling tasks performed on network cards, said plurality of

instructions when executed by a computer, cause said computer to perform:

       upgrading code of an application in an standby state to an active state

           comprising,

               transitioning the application from the standby state to a no provisioning

                   state; and

8   transitioning the application from the no provisioning state to the active

9   state.

1   22.   In a digital communications network, a system for controlling tasks

2   performed on network cards comprising:

3   a CPU subsystem;

4 one or more input/output ports connected to the CPU subsystem for

5 communicating with the network; and

6 special hardware connected to the CPU subsystem via a bus, wherein the

7 CPU subsystem controls applications executed within the network.

1 23. The system of claim 22 further comprising a disk database connected to

2 the CPU subsystem via a PCI bus.

1 24. The system of claim 22, wherein the CPU subsystem comprises:

a central processing unit;

a system controller connected to the central processing unit;

random access memory connected to the system controller; and

an application state machine for transitioning applications between one of

a plurality of active states and one of a plurality of standby states.

ABSTRACT

A method and system for controlling tasks performed on network cards is

disclosed. In one embodiment, the method disclosed controls applications that are

executed within the network. The method of controlling the applications comprises
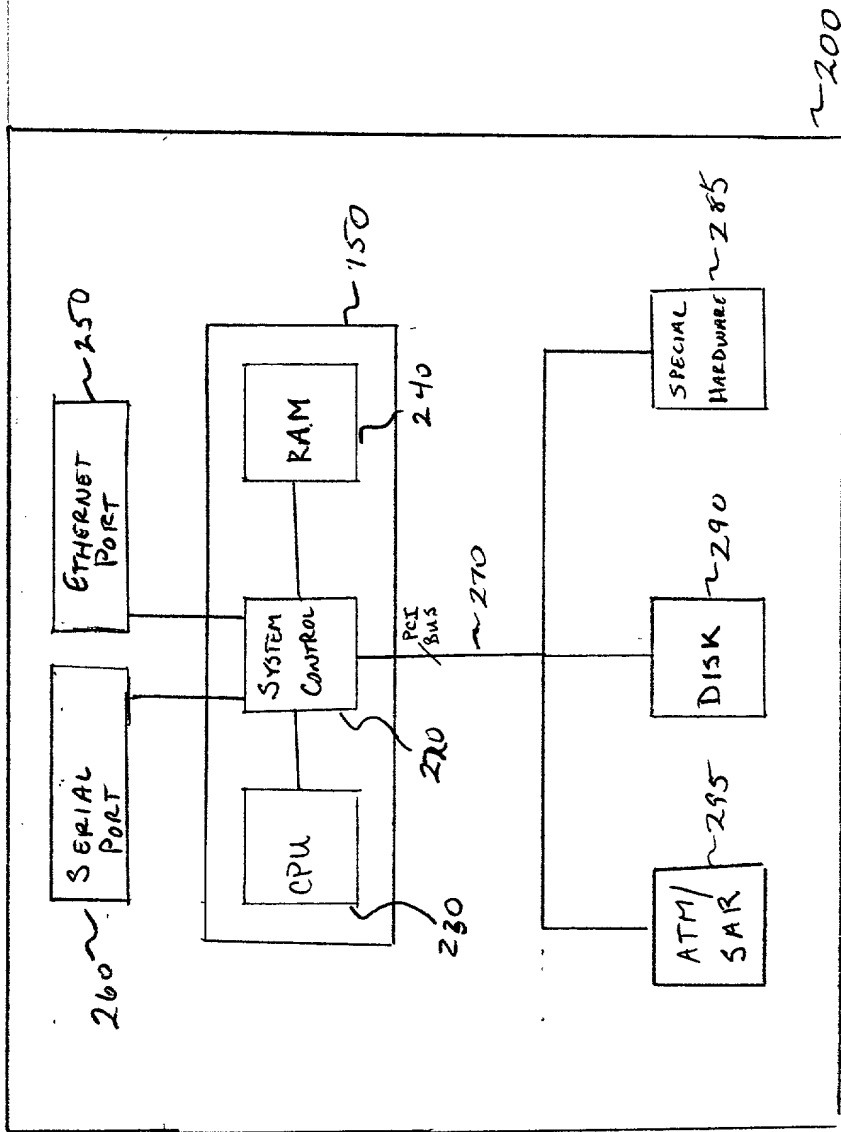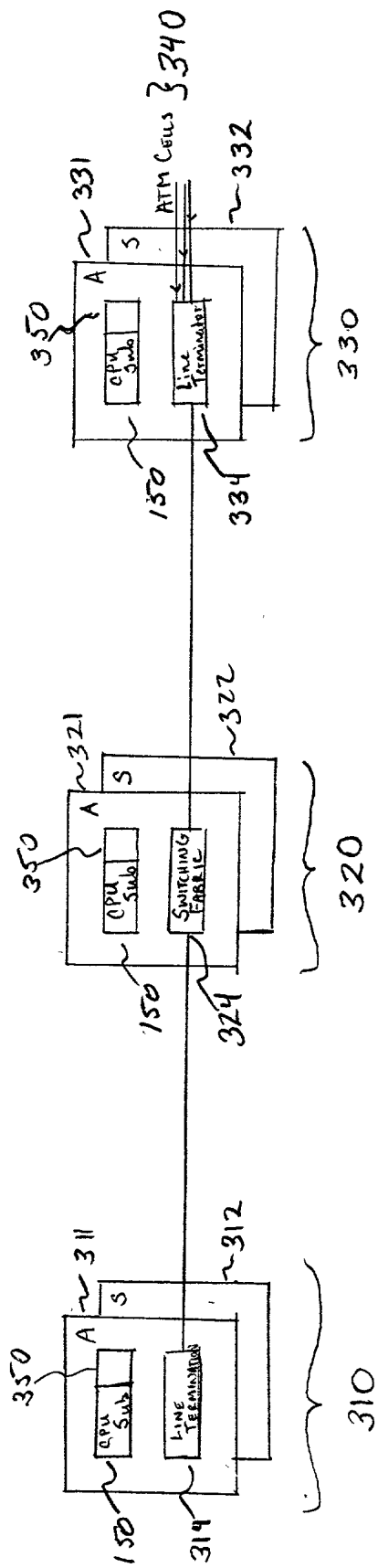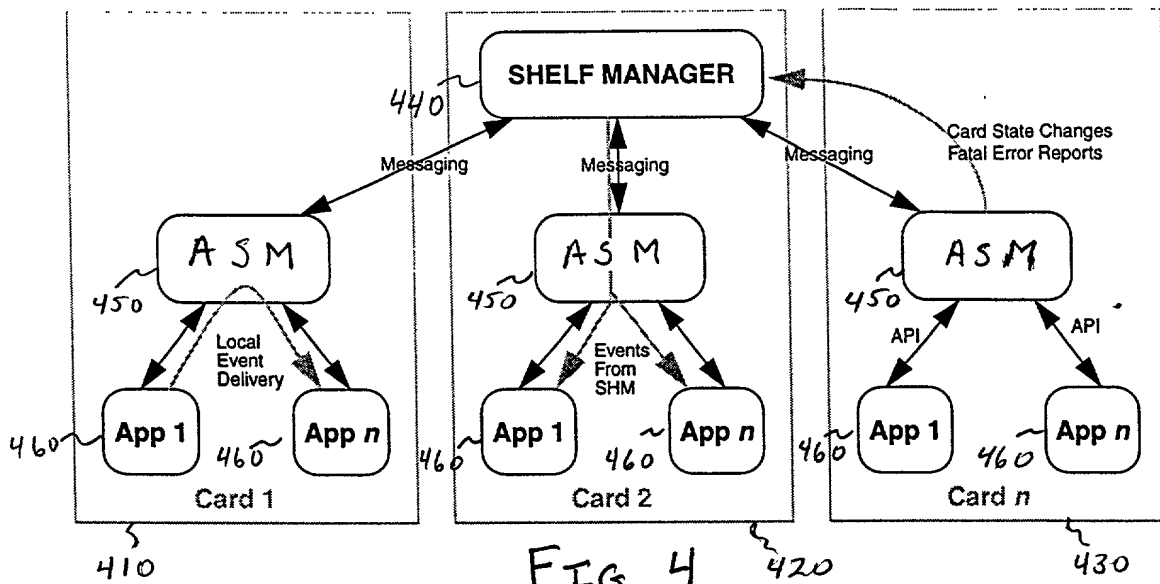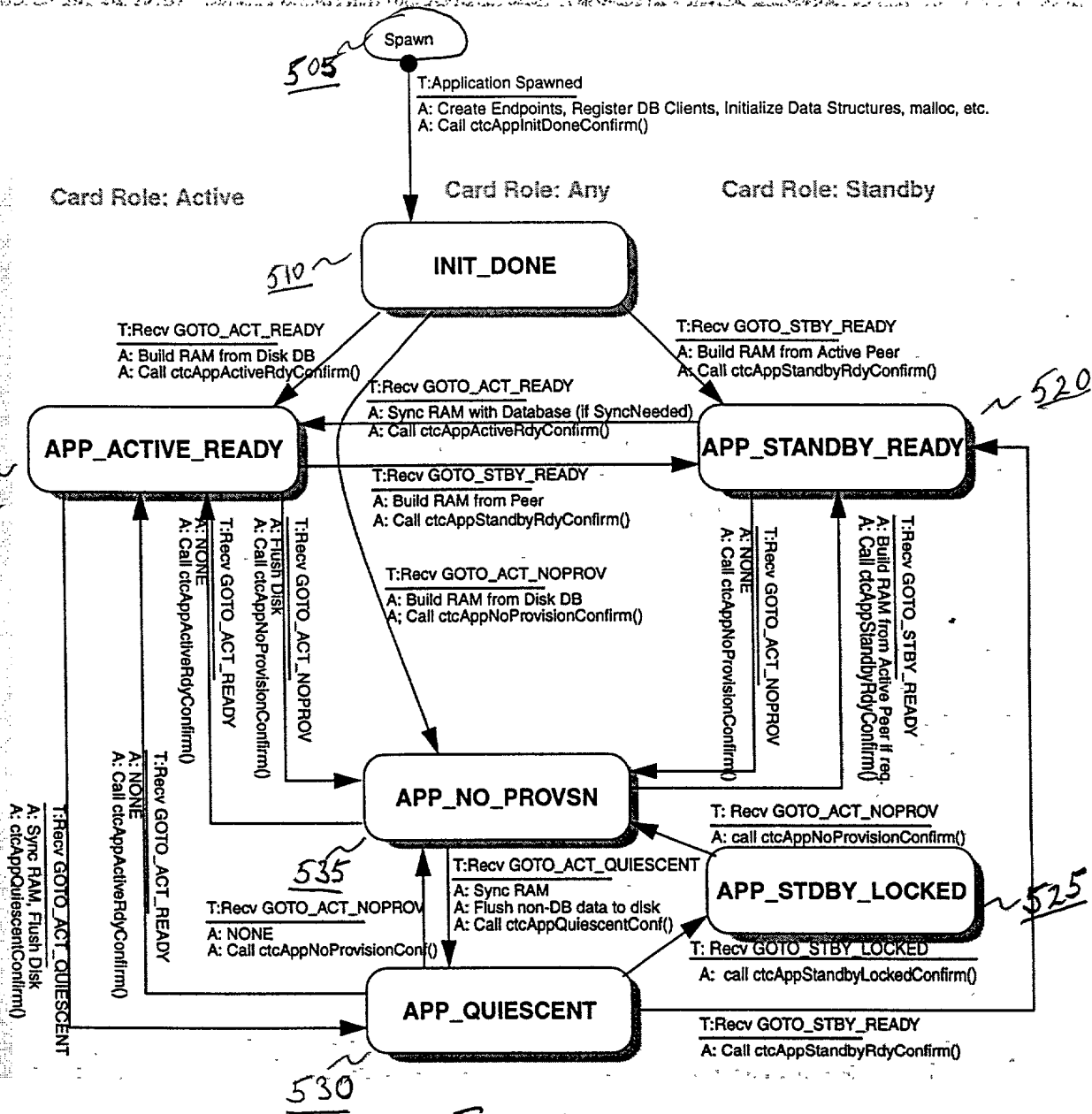
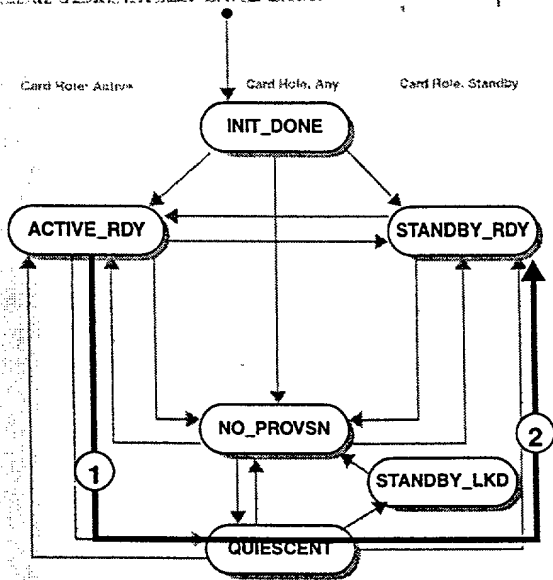transition

FIG. 1

FIG. 2

FIG. 3
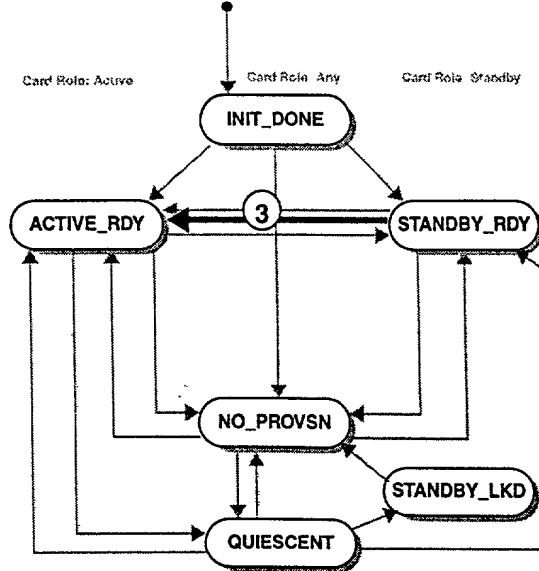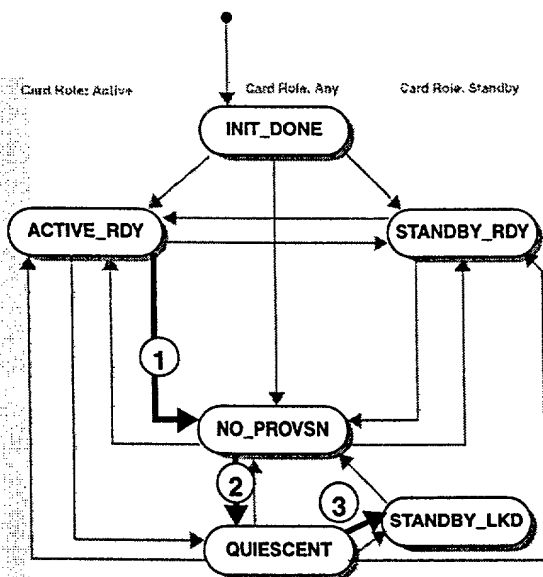
FIG. 4
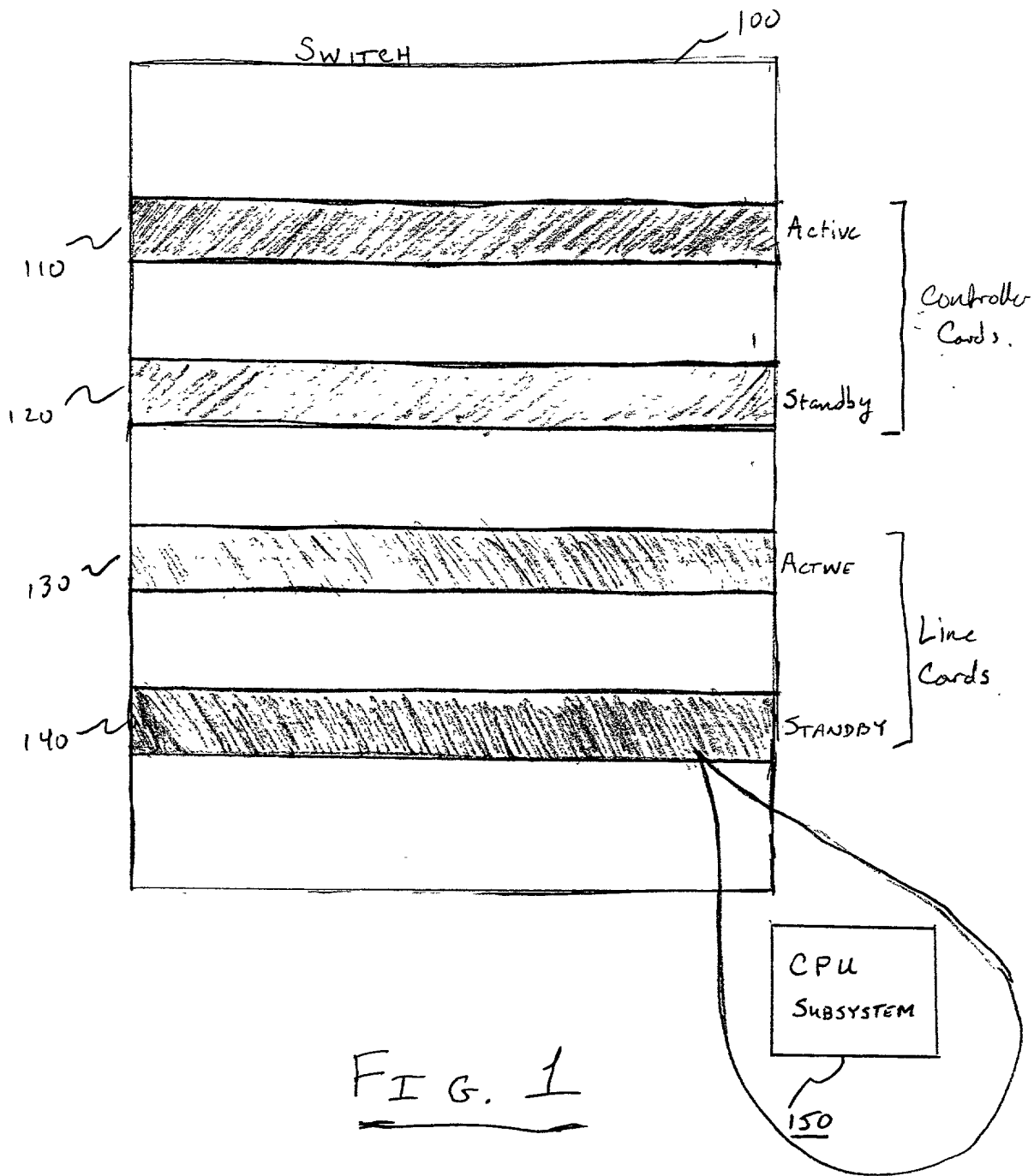
FIG. 5

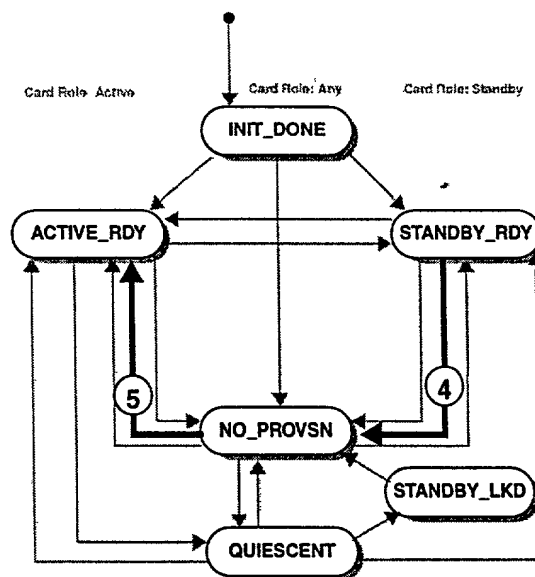**Active-Standby Graceful Switchover**

FIG. 6A

Standby-Active Graceful Switchover

FIG. 6B

Active-Standby Upgrade Switchover

FIG. 6C

Standby-Active Upgrade Switchover

FIG. 6D

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled
 _METHOD AND SYSTEM FOR CONTROLLING TASKS ON NETWORK CARDS_____

the specification of which

    __x__   is attached hereto.
    ____   was filed on _____as
               United States Application Number _____
               or PCT International Application Number _____
               and was amended on _____.
                                     (if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above. I do not know and do not believe that the claimed invention was ever known or used in the United States of America before my invention thereof, or patented or described in any printed publication in any country before my invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months (for a utility patent application) or six months (for a design patent application) prior to this application.

I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)

(Number)	(Country)	(Day/Month/Year Filed)	Yes	No
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No

I hereby claim the benefit under title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below:

(Application Number)	Filing Date
(Application Number)	Filing Date

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Number)	Filing Date	(Status -- patented, pending, abandoned)
(Application Number)	Filing Date	(Status -- patented, pending, abandoned)

I hereby appoint the persons listed on Appendix A hereto (which is incorporated by reference and a part of this document) as my respective patent attorneys and patent agents, with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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APPENDIX B

Title 37, Code of Federal Regulations, Section 1.56
Duty to Disclose Information Material to Patentability

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclosure information exists with respect to each pending claim until the claim is cancelled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is cancelled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclosure all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

(1)   Prior art cited in search reports of a foreign patent office in a counterpart application, and

(2)   The closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b)   Under this section, information is material to patentability when it is not cumulative to information already of record or being made or record in the application, and

(1)   It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or

(2)   It refutes, or is inconsistent with, a position the applicant takes in:

(i)   Opposing an argument of unpatentability relied on by the Office, or

(ii)   Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c)   Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

(1)   Each inventor named in the application;

(2)   Each attorney or agent who prepares or prosecutes the application; and

(3)   Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d)   Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.